Mortality among Norwegian medical doctors 1960-2000

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Tonje Strøno Sejersted

Kull H03

Hovedveileder: Erlend Hem
Biveileder: Øivind Ekeberg

Universitetet i Oslo

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Erlend Hem, Tonje Strøno Sejersted, Øivind Ekeberg, Olaf Aasland

Department of Behavioural Sciences in Medicine, Institute of Basic Medical Sciences,

Faculty of Medicine, University of Oslo, Norway

Abstract

Introduction

We have investigated the mortality pattern of Norwegian doctors, human service occupations, other graduates and the general population during the period 1960-2000 by decades, gender and age.

Material and methods

Census data from 1960, 1970, 1980 and 1990 relating to education were linked to 14 main causes of death data from Statistics Norway, and followed up for the period 1960-2000. The total overall number of deaths in the study population was 1,583,559.

Results

The doctors had a lower mortality than the general population for all causes except suicide. The relative incidence rate ratios among other graduates and human service occupations were about 0.7-0.8 compared with the general population. However, doctors had a higher mortality than other graduates. The lowest estimates in doctor mortality was from endocrine, nutritional and metabolic diseases, diseases in the urogenital tract or genitalia, digestive diseases and sudden death where the numbers was nearly half of those in the general population. There was a widening of the gap in mortality between doctors and the general population during the period, as there was a pattern of decreasing mortality rates (0.90-0.69 for men, 0.81-0.73 for women) among doctors during 1960-2000.

Discussion

During the 40-year study period the difference in mortality rates between doctors and the general population have increased. Doctors have a higher mortality rate than other graduates that may be explained by the higher suicide rates among doctors.

Introduction

For more than a century, the mortality among doctors has been studied. The belief that doctors, presumably because of the dangers of doctoring and the long hours of work under stressful conditions, have a life expectancy shorter than that of the general population was long held in the medical community (Williams et al, 1971; Martensen, 1996). Ogle stated in a classic paper in 1886 that the mortality rate in the medical profession was "extremely high", and in fact ascribed part of the excess mortality to the doctors habits of heavy drinking (Ogle, 1886). In a historical perspective, doctors in western industrialised countries seemingly had a higher mortality rate than the general population until about 1950 (Dickinson & Martin, 1956; Lindhardt et al, 1961, Lindhardt et al, 1963, Jeune, 1980; Juel et al., 1997, Juel et al, 1999). Danish doctors' age-adjusted mortality rate decreased from 16.9 per 1,000 in 1935 to 11.1 per 1,000 in 1959 compared with 14.0 and 11.2 among all Danish males, respectively (Lindhardt et al, 1963). Presently, it seems that doctors enjoy a lower mortality rate than what is seen in the general population (Balarajan, 1989; Carpenter et al.,1997, Alexander et al. 2000, Ullmann et al., 1991, Frank E, 2000, Hall et al., 1991, Rimpelä et al, 1987, Samkoff et al., 1995, Torre et al., 2005, Juel et al 1999, Frank et al., 2000, Innos et al., 2002). However, in most studies doctors have a high rate of suicide (Balarajan, 1989; Hem et al, 2005, Schernhammer et al 2004, Hall et al., 1991, Rimpela et al, 1987, Juel et al 1999, Alexander et al. 2000, Frank et al, 2000, Torre et al, 2005) and violent deaths (Juel et al 1999), although there are some exceptions (Rimpela et al, 1987, Hawton et al, 2001; Innos et al, 2002). Most studies have compared mortality rates among doctors with those of the general population or within the medical profession and not with comparable socioeconomic groups. Thus, some older studies have shown that physician mortality is unfavorable compared with other professionals and men in the same socioeconomic category (King et. al 1969, Doll et al, 1977, Araki et al., 1986, Rimpelä et. al., 1987), but data are inconsistent (Frank et al, 2000). The most recent studies have used wrong statistical methods (Wright & Roberts, 1996), proportionate mortality ratios instead of standardized measures (Calvert et al, 1999, Frank et al 2000), compared with other medical specialists (Alexander et al 2000, Juel et al 1999, Redelmeier & Kwong, 2004, Torre et al, 2005) or the general population (Juel et al, 1999; Innos et al, 2002; Torre et al, 2005; Doll et al, 2004) instead of comparable socioeconomic groups.

In Norway doctor mortality has been reported in two studies: Statistics Norway published an analysis regarding mortality in different professional groups in the period 1970-80 indicating a low mortality among doctors and dentists combined (Borgan & Kristofersen, 1986), and Aasland showed that mortality among anesthesiologists and pediatricians was similar to that of other medical specialists (Aasland, 2002).

Healthy doctors are of importance not only to themselves, but also to their patients. For example, it is shown that doctors with a healthy lifestyle more readily discuss prevention with their patients (Frank E, 2000b, Feller et al., 2004). In 1952, 74% of Norwegian doctors were daily smokers, whereas the corresponding figure in 1993 was 14% (Aasland & Nylenna, 1997), which was much lower than the percentage of daily smokers in the general population in Norway (33%) (Disen, 1997). Several studies have shown low

mortality rates from a number of smoking related disorders among doctors (Juel et al, 1999; Torre et al., 2005). In Denmark, the standardized mortality rate for lung cancer and respiratory diseases for doctors during the period 1973-92 was about 0.5 in both genders compared with the general population (Juel et al, 1999). Further, some studies have shown that mortality from heart disease, cancer and diabetes is lower among doctors (Jeune, 1980; Carpenter et al., 1997).

A consistent finding is an increased rate of suicide in the medical profession (Carpenter et al. 1997, Samkoff et al., 1995, Juel et al., 1999, Hem et al 2005, Colditz and Schernhammer, 2004). In a recent meta-analysis, the aggregate suicide rate ratio for male and female doctors, compared to the general population, was 1.4 and 2.3, respectively (Colditz and Schernhammer, 2004). A Danish study also found that female doctors have a high mortality rate due to accidents and violent death (Juel et al, 1999).

Many mortality studies only include male doctors, due to the low number of females. In 1960, 10% of Norwegian doctors were women, whereas the corresponding figures in 2000 and 2008 were 31% and 41%, respectively. Presently, the percentage of female medical students in Norway is 61% (Legeforeningen 2008). Thus there is a need for more studies that include both females and males.

In two previous papers we have investigated the suicide rate among Norwegian female and male doctors from 1960 to 2000, compared with human service occupations or with the general population (Aasland et al., 2001, Hem et al 2005). In the present paper we wanted to extend the scope to general mortality data. This is the first nationwide study focusing on doctors, other graduates and the general population over a 40-year time period.

We compared doctors with other human service occupations because there may be specific professional burdens that distinguish them as a group from other professions, such as burnout and emotional pressure. Previous studies have shown great differences in mortality within the health sector (Balarajan, 1989). We have previously shown that the suicide mortality rate among Norwegian doctors was higher during the period 1960-2000 compared with human service occupations (Hem et al, 2005). Thus, we wanted to investigate the mortality pattern during the period 1960-2000 by decades, gender and age.

We compared doctors to other graduates to take the socioeconomic factor and the healthy worker effect into account. In western industrialised countries, the social differences in health are increasing (Balarajan, 1988; Drever et al, 1996; Singh & Siahpush, 2006). However, in the Scandinavian social democratic welfare states we **hypothesized** that there would not be increasing differences in mortality between graduates and the general population. Moreover, we **hypothesized** that a convergence of mortality rates between doctors and graduates because people belonging to the same group tend to assimilate to the same type of lifestyle. It is suggested that doctors gradually will come to have the same mortality rate as other highly educated individuals (Aasland 2004). The increased focus upon and knowledge of lifestyle related illness in the society and the degrading of

the doctors as a prestigious occupation would indicate converging of the mortality rates with those of other professions.

Material and methods

Information on education was taken from population censuses conducted in 1960, 1970, 1980 and 1990. In the 1960 and 1970 censuses, education was coded according to information from personal visits to each household. In the 1980 and 1990 censuses, register data for highest education was used to determine education. In the 1960 Census, education was grouped on the basis of an internal list of coding worked out by Statistics Norway (Børke, 1983). From the 1970 Census onwards, education was coded according to the Norwegian Standard Classification of Education, which is compatible with the International Standard Classification of Education (ISCED, 1997).

The groups were divided into trained doctors, dentists, nurses, theologians and police; other graduates (excluding doctors, dentists and theologians); and others (i.e. all other inhabitants in Norway > 20 years). Other human service educations, such as auxiliary nurses, psychologists and social workers, were not included in the present study because of unreliable or unavailable data for the whole study period.

The groups were differentiated by gender and 5-year age categories above the age of 20 years. The total number of person-years among men was 46 744 079 and among women 49 965 874.

During the four decades, different versions of the International Classification of Diseases (ICD) were used (ICD-7, ICD-8, ICD-9 and ICD-10). See appendix for a detailed listing of the causes of death.

Statistical analyses

The analyses were conducted using the STATA statistical package (StataCorp, 2003). The mortality rate was computed as number of deaths per 100 000 person-years. Ninety-five per cent confidence intervals (CI) were computed by approximate Wald limits (Greenland & Rothman, 1998). Decades were compared by testing the ratio between rates. A p value of < 0.05 was considered statistically significant.

Results

As shown in Table 1, the total overall number of deaths in the study population was 1,583,559 over a period of 40 years. The relative incidence rate ratios among graduates and human service occupations were 0.7-0.9 compared with the general population.

All the male professionals, in both the human service occupations and the other graduates, had a significantly lower mortality rate than that of the general population. This was also seen among the women, although not for the female theologians and the police officers due to small numbers.

There were significant differences in mortality rates between the groups (Table 1). The male doctors, police and nurses had a significantly higher mortality rates than t the other

graduates group. The mortality rates among other graduates, theologians and dentists did not differ significantly. There were no significant differences between these groups among women.

Table 2 shows a decreasing mortality rate ratios among male doctors during 1960-2000, but not statistically significant among women. A similar pattern was shown in the other graduates group. Figures 1 and 2 show the mortality trends from 1960 to 2000 for male and female doctors and other graduates respectively. For males there is a steady decline and no significant differences between the two groups, but the values converge over time (Figure 1). No big difference between the two groups is seen from 1960-2000. Figure 2 shows that female physicians had an increasing mortality rate up until the 1980s compared with the female other graduates, but in the 1990s the mortality rates between the two groups seems to have converged. On the other hand, the female nurses had a low and stable mortality rate during all the decades (Table 2).

Table 3 shows mortality rate ratios from specific causes of death among doctors and other graduates. Both groups have lower mortality rate ratios than the general population for most causes of death. Doctors did not differ significantly from the other graduates. The only really high estimates for doctors were seen in suicide, especially among female doctors. The other graduates had low suicide mortality rates. The lowest estimates of doctor mortality were for endocrine, nutritional and metabolic diseases, diseases in the urogenital tract or genitalia, digestive diseases and sudden death, with ratios about 0.60 (Table 3). As the figures for the other human service occupational groups did not differ significantly from the other graduates, these data are not shown.

For the total period doctors in all age groups, except the oldest, had a higher mortality rate than other graduates. For male nurses and all female graduates the age effect was less pronounced (data not shown). In the age group 40-59 years, the mortality rate ratios from cardiovascular diseases among male doctors was 0.58 (95 % CI 0.50-0.67) and in other graduates 0.57 (95 % CI 0.54-0.60). Among female graduates the figure was even lower (0.39; 95 % CI 0.28-0.55).

Tables 4 and 5 show that doctors did not have a lower mortality rate from cancer and respiratory diseases than did other graduates or nurses. There is no evident time effect and the mortality rate, especially from respiratory diseases, has been low throughout the period compared with the general population. However, all graduates including doctors had significantly lower incidence of death from respiratory diseases than in the general population. In the age group 40-59 the IRR among other graduates was 0.39 (95 % CI 0.31-0.51) and 0.37 (95 % CI 0.16-0.82) among men and women, respectively. (Table not shown).

Table 6 shows that doctors and other graduates had a pattern of decreasing mortality from cardiovascular diseases during 1960-2000; 0.91 to 0.60, and 0.83 to 0.62, respectively.

Table 7 shows low mortality rates from accidents among physicians and no decade effect. Also, other graduates had a very low mortality rate from poisoning (0.29), whereas male

doctors had a significantly lower mortality rate from sudden death (0.59) compared with the general population (see Table 3).

Discussion

A main finding in this study was that the doctors had a lower mortality than the general population for all causes except suicide. Second, doctors had a higher mortality than other graduates, but this difference is decreasing. Our data can not fully explain these findings, and the increasing knowledge about and change to healthier lifestyle has so far not resulted in lower mortality rates. However, health related behaviour is complex and consists of much more than rational choice (McCarron et al 2003). Human service occupations are emotionally challenging, and for example the concept of burnout was first established in these groups. Concern has often been expressed about the long hours of stressful work among doctors (Carpenter et al., 1997). Moreover, it has been shown that coronary heart disease increased significantly among doctors as the "degree of stress" by specialty advanced (King H, 1970). In the present study, police had higher mortality rates than doctors, and theologians had very low mortality rates, as was shown for suicide mortality rates in our previous study (Hem et al, 2005). As human service occupations constitute a fairly heterogeneous group both regarding education and socioeconomic factors, it may be difficult to detect general patterns in mortality rates.

The higher mortality among doctors compared with other graduates is in line with other studies (King,1970, Jeune, 1980, Araki 1986, Rimpelä 1987, Balarajan 1989). Interestingly, the mortality rate has converged for female physicians and other female graduates during the last decade, whereas there was a widening of the gap during 1960-1980. A similar increased mortality rate among female physicians graduated after 1960 has also been found in Denmark (Juel et al. 1997), which has been ascribed to the higher strain of being female compared with male doctor. An alternative explanation is regression to the mean.

There was a pattern of decreasing mortality rate among doctors as well as the other graduates compared with the general population during 1960-2000. This is in line with findings from other countries where trends in mortality have shown a relative widening of social differentials developing over the last decades (Balarajan, 1988; Drever et al, 1996; Singh & Siahpush, 2006). During the period 1960-2000, the average life expectancy for Norwegian women and men increased from 75.6 to 81.4 years and 71.3 to 76.0 years, respectively (SSB).

The present study shows that doctors had a lower mortality rate from lifestyle related diseases such as cardiovascular and respiratory diseases. This is in line with previous findings (Jeune, 1980; Carpenter et al, 1997). Previous studies have found low mortality from lung cancer (Juel et. al, 1999, Torre et al., 2005). In the present study, cancer mortality was not significantly lower among doctors. This may be due to the fact that cancer as a whole is not strongly lifestyle related. Previously, doctors had an increased cardiovascular mortality (Lindhardt 1940; Dublin & Spiegelman, 1947; Dickinson & Martin, 1956; King, 1970; Williams et al, 1971; Jeune, 1980), but the rates have decreased and are now lower than in the general population (Rimpela, 1987; Balarajan,

1988; Ullmann et al., 1991; Samkoff et al, 1995; Carpenter et al, 1997; Juel et al, 1999; Innos et al, 2002; Torre et al, 2005), although studies from Japan and Iceland contrast these finsings (Araki et al, 1986; Rafnson & Gunnarsdottir, 1998). Cardiovascular diseases are clearly lifestyle related and cardiovascular mortality is more susceptible to changes in lifestyle changes, with smoking cessation as a very strong candidate (Doll et al, 2004).

Although the daily smokers percentage among doctors have decreased greatly during the last decades, the present study shows that there has not been a decreasing mortality rate among Norwegian doctors of respiratory diseases. Doll et al suggests that a substantial progressive decrease in the mortality rates among non-smokers over the past half century due to prevention and improved treatment of disease has been wholly outweighed, among cigarette smokers, by a progressive increase in the smoker versus non-smoker death rate ratio due to earlier and more intensive use of cigarettes (Doll et al, 2004). Rimpelä et al (1987) suggested that non-smoking can not explain a low mortality rate from respiratory diseases because Finnish doctors smoke as much as other well-educated groups, but have a lower mortality rate. Thus, they suggested three possible explanations for low cancer mortality: chance, better health care and earlier diagnosis, or healthier lifestyle. In a later analysis, they ruled out the possibility of chance and medical care. That left environment and life style as the most likely explanations (Nurminen et al, 1988). In western countries, doctors presumably have better access to health services and the financial resources to obtain good medical care and healthy habits. In the Nordic countries, there has traditionally been equal access to health services for all socioeconomic groups and a profound effect on mortality is less likely. Some authors state that doctors attend cancer screening more often (Feller et al), are more attentive, get diagnosed more often and earlier, and have lower mortality rates. A Norwegian study found that morbidity is lower among doctors, particularly when measured as sickness absence from work (Rosvold et al, 2000). However, many of these statements are not empirically based, and other studies have shown that doctors seek help later than other people (Satoh et al 2002; Hem et al, 2005) and therefore may have a more serious disease when they get professional help, especially when it comes to depression and other psychiatric disorders.

Regarding the specific causes of death, the doctors only had a higher mortality rate than the general population in one specific cause of death, suicide. Nearly 5% of the deaths among female doctors during the period 1960-2000 were due to suicide (13/280). These figures are discussed in great detail in our previous paper (Hem, et al). As the mortality rates in general among doctors and other graduates were quite similar as seen in Table 3, the increased suicide rate among doctors may explain the increased mortality ratio compared to other graduates as seen in Table 1.

In our previous paper we did not investigate other causes of death which may be used in death certificates instead of suicide (Hem et al, 2005). In the present paper, we wanted to look into this because some studies have shown high numbers of accidental poisoning in men, but high suicide mortality from poisoning and injury in women (Carpenter et al, Alexander et al.). However, we did not find higher mortality rates from sudden death, accidental death or unknown cause, but actually a lower mortality rate among male

doctors and other graduates. This is different from the findings in a Danish study, which showed a relatively high mortality due to accidents and other types of violent death among female Danish doctors 1973-92 (Juel et al. 1999). One reason for this may be different routines in registration of death (Jougla et al, 1998).

In this study, no specific cause of death for women stood out except suicide. This is again different from denmark, where there an increased SMR for female doctors (SMR 136) in the early 1970s (Jeune, 1980), and a similar pattern in the general population during the period 1973-92 (Juel et al, 1999). However, few and conflicting data are available (Ackermann-Liebrich, 1991; McManus 1995). However, the number of women in the present study was small and therefore many of the results were inconclusive.

Strengths and limitations

The study covers a 40-year time period and it is the longest study period published so far. Moreover, the study is nationwide and includes many professional groups. The reliability and validity of both the educational and suicide statistics are generally good.

Despite the 40-year time period, the number of deaths from some causes will inevitably be rather low. Thus, some of the groups will be too small for comparison, like, male nurses and professional women.

The validity and reliability of suicide statistics is also a well-known problem. In previous studies, there is some indication of underreporting of suicide among doctors (Rimpela¨ et al. 1987; Carpenter et al. 1997). In the present study, mortality rates for other cause-of-death groups were calculated (accidents, poisonings and other violent death), and there was no indication of higher rates among physicians, even compared to other graduates. Norway is one of very few countries where suicide statistics have been deemed reliable (Hem et al 2005).

Some previous studies have focused on subgroups of diseases, such as diabetes and lung cancer. In the present study, however, we have focused on the major disease entities (see appendix).

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Table 1. Number of deaths and all-cause relative incidence rate ratios, 1960–2000

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Education	**Number of deaths**	**Men**		**Women**	
		N	*Relative incidence rate ratios (95% CI)*	*N*	*Relative incidence rate ratios (95% CI)*
Doctors	2,845	2,565	**0.76 (0.73-0.79)**	280	**0.83 (0.74-0.94)**
Dentists	1,413	1,146	**0.75 (0.70-0.79)**	267	**0.72 (0.64-0.81)**
Nurses	12,228	295	**0.87 (0.77-0.97)**	11,933	**0.79 (0.78-0.81)**
Theologians	1,328	1,307	**0.73 (0.69-0.77)**	21	0.71 (0.46-1.09)
Police	1,702	1,691	**0.87 (0.83-0.91)**	11	1.17 (0.65-2.10)
Other graduates	17,981	16,475	**0.71 (0.70-0.72)**	1,506	**0.77 (0.73-0.81)**
Others	1,546,062	810,543	1 (reference)	735,519	1 (reference)
Total	1,583,559	834,022		749,537	

Table 2. All-cause relative incidence rate ratios by decade, 1960–2000

Education	**Decade**	**Men**		**Women**	
		N	*Relative incidence rate ratios (95% CI)*	*N*	*Relative incidence rate ratios (95% CI)*
Physicians	1960-69		**0.90 (0.82-0.99)**		0.81 (0.56-1.16)
	1970-79		**0.79 (0.73-0.86)**		0.87 (0.67-1.13)
	1980-89		**0.75 (0.70-0.80)**		0.98 (0.80-1.21)
	1990-99		**0.69 (0.65-0.74)**		**0.73 (0.60-0.88)**
Dentists	1960-69		**0.84 (0.73-0.97)**		0.91 (0.68-1.21)
	1970-79		**0.87 (0.77-0.98)**		**0.57 (0.43-0.76)**
	1980-89		**0.66 (0.59-0.74)**		**0.75 (0.60-0.93)**
	1990-99		**0.70 (0.64-0.78)**		**0.72 (0.58-0.88)**
Nurses	1960-69		0.89 (0.69-1.13)		**0.83 (0.79-0.87)**
	1970-79		1.09 (0.84-1.41)		**0.79 (0.76-0.82)**
	1980-89		0.90 (0.72-1.13)		**0.81 (0.78-0.84)**
	1990-99		**0.75 (0.62-0.91)**		**0.77 (0.75-0.80)**
Theologians	1960-69		**0.74 (0.65-0.84)**		1.92 (0.72-5.13)
	1970-79		**0.73 (0.66-0.81)**		0.29 (0.04-2.07)
	1980-89		**0.75 (0.68-0.83)**		0.69 (0.31-1.54)
	1990-99		**0.68 (0.61-0.76)**		0.65 (0.35-1.20)
Police	1960-69		0.97 (0.84-1.11)		1.66 (0.23-11.81)
	1970-79		0.90 (0.81-1.01)		1.30 (0.33-5.22)
	1980-89		**0.86 (0.79-0.94)**		1.06 (0.34-3.30)
	1990-99		**0.83 (0.76-0.89)**		1.12 (0.46-2.68)
Other graduates	1960-69		**0.82 (0.79-0.85)**		**0.73 (0.63-0.84)**
	1970-79		**0.73 (0.71-0.76)**		**0.82 (0.73-0.93)**
	1980-89		**0.71 (0.69-0.73)**		**0.83 (0.76-0.91)**
	1990-99		**0.65 (0.64-0.67)**		**0.72 (0.67-0.78)**
Others			1		1

Table 3. Mortality from specific causes of death among doctors and other graduates, 1960-2000

Cause of death	Numbers of deaths	Doctors			Other graduates		
			Men	Women		Men	Women
All causes	20826	2845	**0.76 (0.73-0.79)**	**0.83 (0.74-0.94)**	17981	**0.71 (0.70-0.72)**	**0.77 (0.73-0.81)**
Infectious and parasitic diseases	177	25	0.80 (0.52-1.22)	1.36 (0.51-3.63)	152	**0.76 (0.65-0.91)**	0.75 (0.43-1.29)
Cancer	5643	740	**0.87 (0.81-0.94)**	0.85 (0.68-1.06)	4903	**0.83 (0.80-0.85)**	0.92 (0.85-1.01)
Endocrine, nutritional and metabolic diseases	191	25	**0.51 (0.33-0.78)**	0.73 (0.27-1.95)	166	**0.54 (0.46-0.63)**	**0.41 (0.24-0.70)**
Cardiovascular diseases	9396	1258	**0.71 (0.67-0.76)**	**0.71 (0.59-0.86)**	8138	**0.69 (0.67-0.71)**	**0.65 (0.60-0.71)**
Sudden death	492	59	**0.59 (0.45-0.77)**	1.16 (0.52-2.59)	433	**0.66 (0.60-0.73)**	0.87 (0.60-1.29)
Respiratory diseases	1453	213	**0.66 (0.57-0.76)**	1.02 (0.71-1.45)	1240	**0.60 (0.57-0.64)**	**0.76 (0.64-0.91)**
Digestive diseases	528	63	**0.59 (0.45-0.77)**	0.77 (0.38-1.54)	465	**0.68 (0.62-0.75)**	**0.56 (0.40-0.78)**
Diseases in urinary and genital organs	306	30	**0.55 (0.38-0.79)**	0.23 (0.03-1.64)	276	**0.73 (0.65-0.83)**	**0.45 (0.25-0.81)**
Other diseases	1069	165	0.88 (0.75-1.03)	0.62 (0.38-1.04)	904	**0.67 (0.62-0.72)**	0.85 (0.71-1.02)
Accidents	839	119	**0.74 (0.61-0.90)**	1.36 (0.82-2.26)	720	**0.67 (0.63-0.73)**	0.93 (0.72-1.20)
Poisonings	35	7	0.51 (0.23-1.13)	1.55 (0.22-11.00)	28	**0.29 (0.20-0.43)**	0.72 (0.23-2.22)
Suicides	455	111	**1.77 (1.45-2.16)**	**2.93 (1.70-5.04)**	344	**0.76 (0.68-0.86)**	1.31 (0.95-1.80)
Other violent deaths	25	6	0.72 (0.27-1.92)	2.84 (0.71-11.35)	19	**0.37 (0.22-0.62)**	0.86 (0.32-2.32)
Cause of death not given	217	24	0.70 (0.46-1.05)	0.40 (0.06-2.83)	193	**0.73 (0.63-0.84)**	1.01 (0.62-1.66)

Table 4. Cancer Relative incidence rate ratios by decade, 1960–2000

Education	**Decade**	**Men**		**Women**	
		N	*Relative incidence rate ratios (95% CI)*	*N*	*Relative incidence rate ratios (95% CI)*
Physicians	1960-69		1.11 (0.91-1.35)		1.13 (0.61-2.09)
	1970-79		**0.83 (0.69-0.99)**		0.53 (0.27-1.07)
	1980-89		0.88 (0.77-1.01)		0.90 (0.59-1.37)
	1990-99		**0.81 (0.72-0.92)**		0.88 (0.63-1.21)
Nurses	1960-69		0.70 (0.38-1.30)		0.91 (0.82-1.01)
	1970-79		0.86 (0.45-1.66)		0.94 (0.87-1.02)
	1980-89		1.18 (0.77-1.82)		**0.90 (0.84-0.96)**
	1990-99		0.79 (0.54-1.16)		**0.85 (0.80-0.90)**
Other graduates	1960-69		0.97 (0.90-1.05)		0.91 (0.70-1.18)
	1970-79		**0.89 (0.83-0.95)**		1.10 (0.89-1.36)
	1980-89		**0.81 (0.76-0.86)**		1.00 (0.84-1.18)
	1990-99		**0.77 (0.73-0.81)**		**0.84 (0.74-0.96)**
Others			1		1

Table 5. Relative incidence rate ratios from respiratory diseases, by decade, 1960–2000

Education	**Decade**	**Men**		**Women**	
		N	*Relative incidence rate ratios (95% CI)*	*N*	*Relative incidence rate ratios (95% CI)*
Physicians	1960-69		**0.52 (0.31-0.86)**		1.13 (0.37-3.52)
	1970-79		**0.61 (0.43-0.86)**		1.40 (0.70-2.80)
	1980-89		**0.74 (0.58-0.95)**		0.65 (0.27-1.56)
	1990-99		**0.65 (0.52-0.82)**		1.04 (0.62-1.76)
Nurses	1960-69		1.11 (0.46-2.67)		**0.72 (0.59-0.88)**
	1970-79		0.52 (0.13-2.09)		**0.69 (0.60-0.80)**
	1980-89		0.81 (0.30-2.16)		**0.81 (0.73-0.91)**
	1990-99		1.14 (0.59-2.19)		**0.75 (0.68-0.82)**
Other graduates	1960-69		**0.68 (0.58-0.79)**		**0.46 (0.23-0.92)**
	1970-79		**0.64 (0.56-0.73)**		0.89 (0.60-1.33)
	1980-89		**0.64 (0.57-0.71)**		0.78 (0.57-1.08)
	1990-99		**0.53 (0.48-0.59)**		0.78 (0.60-1.01)
Others			1		1

Table 6. Cardiovascular Relative incidence rate ratios by decade, 1960–2000

Education	**Decade**	**Men**		**Women**	
		N	*Relative incidence rate ratios (95% CI)*	*N*	*Relative incidence rate ratios (95% CI)*
Physicians	1960-69		0.91 (0.79-1.04)		0.69 (0.39-1.22)
	1970-79		**0.77 (0.69-0.87)**		0.75 (0.50-1.13)
	1980-89		**0.70 (0.63-0.77)**		0.91 (0.66-1.25)
	1990-99		**0.60 (0.54-0.67)**		**0.56 (0.40-0.79)**
Nurses	1960-69		0.98 (0.71-1.36)		**0.81 (0.76-0.88)**
	1970-79		1.19 (0.83-1.70)		**0.75 (0.71-0.80)**
	1980-89		0.88 (0.61-1.25)		**0.80 (0.76-0.84)**
	1990-99		**0.53 (0.36-0.79)**		**0.75 (0.71-0.78)**
Other graduates	1960-69		**0.83 (0.79-0.84)**		**0.73 (0.59-0.90)**
	1970-79		**0.69 (0.66-0.73)**		**0.66 (0.54-0.80)**
	1980-89		**0.68 (0.65-0.70)**		**0.69 (0.59-0.80)**
	1990-99		**0.62 (0.60-0.65)**		**0.59 (0.51-0.68)**
Others			1		1

Table 7. Relative incidence rate ratios from accidents (excl poisonings), by decade, 1960–2000

Education	**Decade**	**Men**		**Women**	
		N	*Relative incidence rate ratios (95% CI)*	*N*	*Relative incidence rate ratios (95% CI)*
Physicians	1960-69		**0.35 (0.18-0.71)**		-
	1970-79		0.95 (0.66-1.37)		0.94 (0.24-3.77)
	1980-89		**0.66 (0.46-0.96)**		1.86 (0.83-4.15)
	1990-99		0.86 (0.62-1.17)		1.51 (0.72-3.16)
Nurses	1960-69		0.51 (0.13-2.03)		1.05 (0.81-1.37)
	1970-79		0.95 (0.31-2.96)		0.84 (0.68-1.04)
	1980-89		0.77 (0.32-1.85)		**0.79 (0.66-0.95)**
	1990-99		0.66 (0.30-1.47)		0.88 (0.75-1.03)
Other graduates	1960-69		**0.55 (0.45-0.67)**		0.74 (0.31-1.77)
	1970-79		**0.67 (0.56-0.79)**		1.37 (0.81-2.31)
	1980-89		**0.82 (0.72-0.93)**		0.61 (0.35-1.08)
	1990-99		**0.64 (0.55-0.73)**		1.05 (0.72-1.52)
Others			1		1

Appendix: ICD codes

		ICD-7	**ICD-8**	**ICD-9**	**ICD-10**
1	All causes	000-138	000-136	001-139, 2791	A00- B99
2	Infectious and parasitic diseases	140-207	140-209	140-208	C00-C97
3	Cancer	250-289	240-279	240-278, 2792-2799	E00-E96
4	Endocrine, nutritional and metabolic diseases	330-334, 400-468, 5702	390-458	390-459	I00-I99
5	Cardiovascular diseases	7952	7824, 795	7981	R960
6	Sudden death	240-241, 244-245, 470-527	460-519	460-519	J00-J99
7	Respiratory diseases	530-587	520-577	520-579	K00-K93
8	Digestive diseases	590-637	580-629	580-629	N00-N99
9	Diseases in urinary and genital organs	Rest. (001-799)	Rest. (001-796)	Rest. (001-799)	Rest. (A00-A98)
10	Other diseases	800-866, 900-965	800-845, 880-949	800-848, 870-949	V00-X39, X50-X59, Y85-Y86
11	Accidents	870-895	850-877	850-869	X40-X49
12	Poisonings	970-979	950-959	950-959	X60-X84, Y870
13	Suicides	Rest. (800-999)	Rest. (800-999)	Rest. (800-999)	Rest. (V00-Y99)
14	Other violent deaths	Blank, 7955	Blank, 7969	Blank, 7995-7999	Blank, R99